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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/493,983	01/28/2000	Hirokazu Yashiro	1018.1117101	2906

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EXAMINER	
MULLINS, BURTON S	
ART UNIT	PAPER NUMBER
2834	

DATE MAILED: 10/01/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/493,983	YASHIRO ET AL.	
	Examiner	Art Unit	
	Burton S. Mullins	2834	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- *Extensions of time may be available under the provisions of 37 CFR 1.136(a).* In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *30 August 2002* .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-28* is/are pending in the application.

4a) Of the above claim(s) *17-27* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-16 and 28* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

2. Claims 1-7, 9-11 and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Konno et al. (US 5,089,732) in view of Weilbach et al. (US 5,019,738). Konno teaches the basic spindle motor shaft and cylindrical radial bearing (Fig.6) comprising: cylindrical rotary member 7 attached to rotary shaft 6b; a cylindrical fixed surface 2 surrounding the rotary member 7, wherein the fixed surface 2 is spaced from the rotary member 7 by a predetermined distance (determined by the radial bearing 4); and armature coils 5 arranged about a peripheral surface of the fixed surface 2 to rotate the rotor 6, and thus the shaft 6b.

Konno does not teach that the rotary member has a coefficient of thermal expansion smaller than that of the fixed surface.

Weilbach teaches a motor bearing arrangement comprising a rotary shaft 46 and a surrounding cylindrical bearing sleeve 40 which forms a bearing surface 48 therebetween. As shown in Table 1 (c.6), the shaft may be of ceramic while the sleeve is steel. Ceramics such as silicon carbide have lower coefficient of thermal conductivity, usually 3-4 x 10^{-6}/ C, smaller than the thermal conductivity of most steels, e.g. 110 to 170 x 10^{-6}/ C (see http://www.sni.net/~fjlawson/matlprops.html#thermal_exp). Of the various combinations in Table 1 providing successful bearing arrangements, Weilbach further points out that the steel sleeve and ceramic shaft combination has been found to be the "most reliable" (c.11, line 56-58). This is because the steel sleeve and ceramic shaft have closely matched thermal

coefficients of expansion, the steel sleeve may function as the rotor and thus eliminate the need for permanent magnets, and the combination has high corrosion resistance (c.11, lines 60-65).

It would have been obvious to one having ordinary skill in the art to provide a steel fixed surface and a ceramic rotary surface having a smaller coefficient of thermal expansion per Weilbach in the cylindrical rotary member of Konno since this would have been desirable to provide the most reliable, high precision bearing having the advantages of closely matched coefficients of thermal expansion and increased corrosion resistance.

Regarding claim 2, the difference in thermal expansion between ceramic and a typical steel as taught in Weilbach is much greater than the claimed minimum value.

Regarding claims 3 and 9, the value for a typical ceramic such as silicon carbide used as the rotating shaft in Weilbach is typically 3-4 x 10^{-6}/ C .

Regarding claims 4-5, hard anodized aluminum, or alumina, is taught as the sleeve surface in Weilbach.

Regarding claims 6-7 and 10-11, note that the rotary member in Weilbach can be made of a ceramic. Ceramics include ceramic carbide material such as silicon carbide (see Konno '173, c.14, lines 65-67).

Regarding new claim 28, the claimed method of production would be inherent in the construction of the machine of Konno and Weilbach.

3. Claims 8 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Konno et al. (US 5,089,732) and Weilbach as applied to claims 1 and 9 above, and further in view of Conrad (US 5,707,213). Neither Konno nor Weilbach teach a case accomodating the bearing, rotary member and fixed surface, wherein the case has a slit for cooling these elements.

Conrad teaches a molecular vacuum pump including a case surrounding the stator windings (drive 7), bearings 8/9 and pump rotor/stator 2/3. The case includes slits comprising inlets 12-14 for cooling gas which cools the pump (c.3., lines 5-10).

It would have been obvious to one having ordinary skill in the art at the time of the invention to modify the structure of Konno and Weilbach and provide a case accomodating the bearing with slits per Conrad since it would have been desirable to cool the motor.

4. Claims 13-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Konno et al. (US 5,089,732) in view of Weilbach et al. and Yashiro (JP 2-16389). As discussed above, Konno teaches the general cylindrical bearing structure.

Konno does not teach that the rotary member has a coefficient of thermal expansion smaller than that of the fixed surface. Neither does Konno teach a turbo-molecular pump, per se.

Regarding the former feature, Weilbach teaches a motor bearing arrangement comprising a rotary shaft 46 and a surrounding cylindrical bearing sleeve 40 which forms a bearing surface 48 therebetween. As shown in Table 1 (c.6), the shaft may be of ceramic while the sleeve is of hard anodized aluminum, i.e., alumina or aluminum oxide. Also, the shaft can be of ceramic while the sleeve is steel. Ceramics such as silicon carbide have lower coefficient of thermal conductivity, usually 3-4 x 10^{-6}/ C , smaller than the thermal conductivity of most steels, e.g. 110 to 170 x 10^{-6}/ C (see http://www.sni.net/~fjlawson/matlprops.html#thermal_exp).). Of the various combinations in Table 1 providing successful bearing arrangements, Weilbach further points out that the steel sleeve and ceramic shaft combination has been found to be the "most reliable" (c.11, line 56-58). This is because

the steel sleeve and ceramic shaft have closely matched thermal coefficients of expansion, the steel sleeve may function as the rotor and thus eliminate the need for permanent magnets, and the combination has high corrosion resistance (c.11, lines 60-65).

Regarding the latter feature, Yashiro teaches a turbo-molecular pump including rotor 17, rotor vanes 16, stator or housing 11, stator vanes 19, and motor 13/14 for rotating the rotor. Yashiro also teaches non-contact, ceramic cylindrical bearings (Figs.4-5; specification, p.1-p.4) for radial and thrust bearings. A fan is also included for cooling the air bearing, as discussed at p.3, line 27 of the specification with regard to Yashiro.

It would have been obvious to one having ordinary skill in the art to provide a steel fixed surface and a ceramic rotary surface having a smaller coefficient of thermal expansion per Weilbach in the cylindrical rotary member of Konno since this would have been desirable to provide the most reliable, high precision bearing having the advantages of closely matched coefficients of thermal expansion and increased corrosion resistance. It would furthermore have been obvious to employ such a bearing on a turbo-molecular pump because high precision would be desirable in high-speed applications such as the turbo-pump in Yashiro, which also uses cylindrical bearings.

Response to Arguments

5. Applicant's arguments filed August 30, 2002 have been fully considered but they are not persuasive. Applicant argues that Weilbach teaches various successful bearing combination surfaces for the rotary and sleeve materials in Fig.1, but that the "thermal expansion coefficients of the sleeve and rotary member are not essential." This is not persuasive

because Weilbach, c.11, line 60, states that closely matched thermal coefficients of expansion are a primary advantage of the steel sleeve and ceramic shaft combination. Several other reasons this particular successful combination is the most reliable one include avoidance of the use of a permanent magnet and high corrosion resistance (c.11, lines 60-65). Thus, it is clear that the steel sleeve and ceramic shaft combination in Table 1 is the preferred one.

Regarding the argument that Weilbach professes a preference for providing a rotary member and a corresponding sleeve with matching coefficients of thermal expansion but does not teach a particular advantage for matching a lower thermal expanding rotary member with a greater thermally expanding sleeve, the examiner points out: 1) Weilbach's preference for "closely matched" coefficients does not mean that the coefficients are identical, i.e., a "closely matched" combination includes the combination of a rotor having a smaller coefficient than the sleeve; and 2) Weilbach, as noted above, explicitly teach a preference for a steel sleeve and ceramic shaft (c.11, lines 54-65). Steel has a smaller coefficient than ceramic material. The fact that applicant has recognized another advantage which would flow naturally from following the suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious. See *Ex parte Obiaya*, 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985).

Conclusion

6. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL.** See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Burton S. Mullins whose telephone number is 305-7063. The examiner can normally be reached on Monday-Friday, 9 am to 5 pm. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nestor Ramirez can be reached on 308-1371. The fax phone numbers for the organization where this application or proceeding is assigned are 305-1341 for regular communications and 305-1341 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 308-0956.

Burton S. Mullins
Primary Examiner
Art Unit 2834

bsm
September 27, 2002